Department of Energy
Washington, DC

FEB 04 2000

Radon-222 Comment Clerk
Docket Number W-99-08
Water Docket (MC-4101)
U.S. Environmental Protection Agency
401 M Street, SW
Washington, DC 20460

Dear Sir or Madam:

Enclosed are comments prepared by the Department of Energy's Office of Environmental Policy and Assistance on the proposed National Primary Drinking Water Regulation for Radon (**64 FR 59246**). Please contact James Bachmaier of my staff at 202-586-0341 or james.bachmaier@eh.doe.gov, if there are any questions on these comments.

Sincerely,

for Raymond P. Berube
Acting Director
Office of Environmental Policy and Assistance

Enclosure

DEPARTMENT OF ENERGY COMMENTS ON THE NOVEMBER 2, 1999 PROPOSED NATIONAL PRIMARY DRINKING WATER REGULATION FOR RADON (64 FR 59246)

The Department of Energy (DOE) has reviewed the subject proposal (40 CFR Parts 141 and 142) for establishing a National Primary Drinking Water Regulation (NPDWR) for radon, as well as the Regulatory Impact Analysis (RIA) dated September 1999, and the Health Risk Reduction and Cost Analysis (HRR&CA) for Radon in Drinking Water dated February 5, 1999. DOE is providing the following comments expressing concern over certain aspects of this proposed rule. These concerns are consistent with positions taken by the Department in the past regarding the Environmental Protection Agency's (EPA) approach to setting standards for radioactive substances in drinking water.

DOE believes that EPA has not adequately characterized the risks of fatal cancers from inhalation of radon, and that, therefore, the anticipated risk reduction of this proposed rule may not be realized. The statement in the preamble (**56 FR 59248**) regarding the National Academy of Sciences (NAS) estimates of annual lung cancer deaths caused by radon in soil gives the impression that there are between 15,000 and 22,000 actual deaths each year attributable to inhalation of radon. In fact, the NAS report that is referenced (the BEIR VI Report entitled "Health Effects of Exposure to Radon") estimates that 15,000 to 22,000 fatal cancers could occur, based on two different modeling approaches, but that there is substantial uncertainty associated with each model, as well as with the health effects data (derived from uranium miner studies) and the assumptions that are used in the model, and with variations in the levels of radon found in indoor air in homes and other buildings across the United States. NAS identifies the sources of uncertainty (Table ES-5 of BEIR VI) and cautions against the use of risk projections without full consideration of the magnitude of the uncertainty. Since many of the sources of uncertainty cannot be quantified, it is possible that the risk projections could be overstated or understated. NAS does suggest that the actual number of fatal lung cancers attributable to radon could be as low as 3000 per year. The actual number may be even lower than 3000, and many of these fatal cancers should more appropriately be classified as due to cigarette smoking, not to inhalation of radon and its decay products. In any case, EPA's brief and unqualified statements on the annual numbers of fatal cancers attributable to radon should be presented as estimates based on models, not as actual mortality data, and that a substantial amount of uncertainty surrounds these estimates. This recognition of uncertainty should be carried forward to estimates of the potential benefits of setting standards for radon in drinking water, where the number of fatal cancers avoided by reducing radon levels in drinking water may never materialize, whereas the costs of implementing the proposed rule would be realized in any case.

While the Department believes that the risk to the general public from radon in drinking water is minor, the approach taken in the current proposal is a significant improvement over the previous proposed rule (**56 FR 33050**, July 18, 1991). Structuring the regulation to include an Alternative Maximum Contaminant Level (AMCL), as mandated in the Safe Drinking Water Act Amendments of 1996, which applies wherever on-going efforts are in place to reduce indoor air radon levels is a more effective approach than merely establishing a Maximum Contaminant Level (MCL), since it recognizes inhalation, not ingestion, as the primary exposure pathway. DOE supports the flexibility provided by the AMCL concept and encourages EPA to adapt this concept to future rulemakings regarding other radioactive substances in drinking water.

While the Department is generally in agreement with the overall concept of an AMCL and a program for reducing radon in indoor air, DOE has concerns about the approach taken by EPA in establishing a system for relying on state-wide Multi-Media Mitigation (MMM) programs to effectively reduce radon levels and thus justify the implementation of the AMCL. Additionally, DOE is concerned about the possible applicability of the proposed rule to Non-Transient, Non-Community Public Water Systems. Finally, DOE has comments on some of the assumptions made by EPA in estimating potential costs and benefits associated with this proposed rule. Each of these concerns, as well as summaries of comments previously provided to EPA on radionuclide standards in drinking water, is addressed in the comments that follow.

1. **Reliance on State-wide MMM Programs to Control Indoor Air Radon Levels**

Although DOE agrees that the more significant human health risks associated with radon are through the inhalation pathway not through ingestion, and that, therefore, establishing an AMCL based on implementation of an MMM program is a potentially more effective approach than merely establishing an MCL, DOE is concerned that state agencies and Community Water Systems (CWS) may not agree with EPA's optimistic conclusions that the AMCL/MMM approach is the most cost effective, and that, therefore, EPA's expectation that most states will develop and implement MMM programs may not be realized. If fewer states develop and implement MMM programs than EPA anticipates, the cost impacts of this rule will be greater, the increased costs will be borne by many more CWS, and the anticipated health benefits will not be realized.

There are a number of reasons for DOE's concern that the AMCL/MMM approach may not be as attractive to states and CWS as EPA expects. The costs of implementing a state-wide MMM program may be excessive, from a state government perspective, even if the state agrees that installing and maintaining additional treatment technology at CWS across the state to meet the MCL would be more expensive. The issue is not overall cost effectiveness, but rather who bears the cost – the state or the CWS. The state agency may decide that it cannot justify or sustain the budget increase needed to implement an on-going MMM program, and that the CWS would be in a better position to obtain funding for improved technology[1], and that the increased costs should be borne by the CWS's customers who would benefit from cleaner water. This logic would seem to apply especially in states where natural background radon levels in ground water are low, and most CWS would be able to meet the MCL without installing additional treatment technology.

In states where an indoor air radon abatement program is already being implemented, the state may feel that it is already addressing and resolving the most serious indoor air radon risks, and that little is to be gained by re-structuring the existing program to meet EPA's criteria, and then seeking EPA's approval for the state's own program. State agencies may also object to EPA's use of Federal authority under the Safe Drinking Water Act to influence or control a state program that is addressing an airborne contaminant. This may especially be true where clean air and safe drinking water are addressed by different state statutes, or are implemented by different state agencies.

In states that elect not to implement a state-wide MMM program, an individual CWS has the option of establishing its own MMM program, which would, presumably, apply to residences in its service area. But wherever this option is pursued by the CWS, there is still a burden on the state agency to approve such CWS-wide MMM programs, using EPA's criteria, and to maintain oversight of the CWS-wide program. EPA has no assurance that the states would be willing to assume this responsibility, since some additional state-level funding would be needed to implement the approval and oversight functions, and since the state agency that typically regulates drinking water systems would now be expected to approve indoor air radon abatement programs. The state may conclude that the additional funding and the organizational and jurisdictional complications involved are not justified.

Additionally, private homeowners may not be willing to cooperate with a state agency (or the local CWS) that has set up a radon testing, inspection, and abatement program that goes beyond the voluntary indoor air radon programs that currently exist in most states. Some homeowners may prefer that the CWS install treatment technology to reduce radon in drinking water, even if the cost is passed along to the rate payer, rather than submit to state-sponsored testing and inspection, and then face the possibility of making expensive renovation of the home to lower indoor air radon levels. As noted previously, the issue is not necessarily one of cost effectiveness, but rather who must pay. The homeowner may not elect to pay for any retrofitting of the home to reduce radon levels in indoor air, thereby nullifying the assumed health benefits of an MMM program. There is no indication in the preamble that EPA would provide financial support to the state to implement a MMM program or to approve and oversee a CWS-wide MMM program, or to the homeowner to retrofit the home to reduce radon levels in indoor air.

For these reasons, the state may not agree with EPA's reasoning that the AMCL/MMM approach is desirable, even though it may be cost effective from the CWS perspective. DOE notes that this concern appears to be shared by at

[1] EPA administers the Drinking Water State Revolving Fund which provides grants to states to set up loan funds for infrastructure improvement at CWS.

least one major utility industry trade association – the American Water Works Association, whose members include over 4000 utilities that supply drinking water to 180 million people. A recent regulatory alert[2] urges AWWA members to begin working with their state agency immediately to convince the state to implement a state-wide MMM program that meets EPA's criteria. Clearly, the utilities are concerned that state agencies may not be as eager to adopt EPA's approach as EPA anticipates.

2. <u>Applicability of the Proposed Radon Rule to Non-Transient, Non-Community Public Water Systems</u>

DOE agrees with EPA's decision to exclude Non-Transient, Non-Community (NTNC) Public Water Systems (PWS) from the radon regulation at this time. As noted in the preamble (**64 FR 59255**), information on how drinking water is used at facilities served by NTNC PWS (industrial facilities, hospitals, schools, etc.) and on the relationship of radon levels in water to the rate of exposure through inhalation at these facilities is limited. For reasons noted in the preamble, EPA lacks the basis for setting standards for radon in drinking water at NTNC PWS to reduce risk from radon inhalation.

However, the preamble also states that if EPA receives additional information on radon occurrence and potential exposures through drinking water at facilities served by NTNC PWS during the public comment period, it will apply the final radon rule to NTNC PWS, **without further opportunity for public review and comment.** DOE strongly objects to this position. If additional data is developed or presented to EPA that would support regulating radon in NTNC PWS, such data and EPA's analysis of it should be presented to the public for review. The relevant occurrence and exposure data, including transfer factors for release of radon from drinking water into indoor air at non-residential settings, would likely be more complex than similar data for residences, for the simple reason that NTNC PWS serve a wide variety of settings. Assumptions regarding occurrence and exposure to airborne contaminants at these settings, which EPA has concluded are similar to those in residential settings, have been made in the context of setting standards for worker protection. Adaptation of these assumptions to evaluating risk from radon in drinking water could be accomplished, but should not be used to set standards without opportunity for public review and comment.

In particular, DOE is concerned about how EPA would develop a radon standard for NTNC PWS that would preserve the AMCL/MMM approach and address inhalation as the primary exposure pathway. State-wide MMM programs, as envisioned by EPA, do not address industrial facilities or other settings that are typically served by NTNC PWS. EPA would have to decide whether the proposed MCL and AMCL levels for radon would also apply at NTNC PWS. Would applicability of the AMCL to NTNC PWS depend on a state-wide MMM program? Would the successful implementation of a state-wide MMM program that was set up to address only residential settings justify the application of the AMCL at 4000 pCi/liter at NTNC PWS? If not, what alternative would EPA pursue? A state-wide MMM program for each type of setting served by a NTNC PWS? Abandonment of the AMCL approach for NTNC PWS and implementation of the MCL only, at either 300 pCi/liter or some other level? In considering these and other relevant issues, EPA would have to make and defend decisions that had not been previously proposed for public review and comment. DOE believes that the Administrative Procedures Act requires EPA to re-propose any standard that may apply to radon levels in drinking water at NTNC PWS, should sufficient information be obtained on occurrence and exposure at any industrial or other facility served by these systems.

3. <u>Certain Assumptions Made in RIA May Not Be Supportable</u>

On page 108 of the September 1999 draft RIA, EPA discusses its use of $700,000 (the average screening and mitigation cost per fatal cancer avoided) as the basis for estimating costs of risk reduction through implementing an MMM program. This average cost is based on data gathered in 1991 and is not adjusted for inflation. It was derived from costs incurred (prior to 1991) in the current voluntary radon mitigation programs that were begun by the states in the late 1980's. It is questionable whether this estimate accurately reflects current and future costs of operating MMM programs, when one considers that past voluntary mitigation of residences is likely to have been much less costly than future mitigation, which EPA assumes will occur in all homes with radon levels above 4 pCi/liter. EPA's statement that personnel from the Office of Radiation and Indoor Air have indicated that costs of screening and mitigation have not increased since 1991 does not justify failing to account for estimated future cost

[2] AWWA Website (http://www.awwa.org) Regulatory Update of November 17, 1999.

increases. It is reasonable to assume that voluntary programs have achieved their goals of completing abatement where costs are relatively low, and considered to be cost effective by the homeowner who must pay for any renovations. It is also reasonable to assume that many homeowners have been unwilling to make more expensive renovations, even if radon levels are above the 4 pCi/liter action level. Future radon abatement may very well involve the more expensive renovation work that has not been completed under the voluntary programs. Therefore, when assuming that all homes will be mitigated, it is prudent to assume that mitigation costs per fatal cancer avoided will increase.

The statement on page 109 of the RIA that there is little information on how MMM programs would be funded or upon whom the costs would fall (state, CWS, or homeowner) betrays EPA's confidence that most states would choose the AMCL/MMM approach since it is most cost effective. Section 8.0 of the RIA discusses availability of Federal funding, but does not (and probably could not) indicate how likely any of these sources of funding would be applied to the costs of MMM program implementation at the state level, given the demands on these sources of funding for all other aspects of the states' drinking water programs and the needs of the CWS. There is no mention of Federal funds being available to private homeowners to cover the costs of renovation of homes for reducing indoor air radon levels.

4. **<u>Summary of Previous DOE Comments</u>**

DOE has previously provided comments to EPA on its approach to setting drinking water standards for radon and for other radionuclides. Two specific comment submittals (dated November 15, 1991 and April 16, 1999 and included with these comments as Attachments I and II, respectively) contain comments that continue to be relevant to the proposed radon standard. These comments are summarized as follows:

a. EPA has not adequately considered the creation of new sources of risk resulting from implementing the radon standard. New sources of risk, which could affect water treatment plant workers, workers at wastewater treatment plants, and workers or the general public that may come into contact with municipal sewage sludge or ash, are associated with the treatment of source water, either by packed tower aeration (PTA) or use of granular activated carbon (GAC).

b. In 1991, DOE had recommended that the MCL for radon be set at 500 pCi/liter rather than 300 pCi/liter, based on the knowledge that the primary exposure pathway is inhalation and that there is a synergistic effect of airborne radon exposure and cigarette smoking. DOE notes that the current proposal provides added flexibility where an indoor air radon abatement program addresses the inhalation exposure pathway, whereas the 1991 proposed rule did not contain such a provision. DOE continues to recommend that the MCL be set at 500 pCi/liter, since the potential risk ($3x10^{-4}$) is still in the acceptable risk range, and that the cost impacts would be less, even though the benefit-cost ratio would be the same (according to EPA's analysis, in Table VII.1 on **64 FR 59270**).

c. The Maximum Contaminant Level Goal (MCLG), which EPA proposes to set at zero, should be set at an attainable (i.e., non-zero) level for naturally-occurring constituents such as radon. Although not intended to constitute a regulatory standard for drinking water systems, the MCLG, like the MCL, can be used to set a regulatory level in some other context (e.g., a pre-treatment requirement for wastewater discharges to a municipal sanitary sewer system, or a ground water remediation standard). When taken out of context, an unattainable standard can create significant financial and legal problems, with little or no environmental benefit.

d. To the extent that GAC is used to treat source water to meet either the MCL or the AMCL, a waste is generated that may contain other radionuclides (e.g., daughter products such as Pb-210) in addition to radon, and may need to be managed as a radioactive waste. The costs and risks involved in the generation of a radioactive waste at a CWS do not appear to have been considered.

DOE believes that these comments have not been adequately addressed by EPA in the RIA prepared for this proposed rule. If adequate consideration is given to the full cost implications of this rule and to the uncertainty that the anticipated health risk reductions will actually materialize, the benefit-cost ratio of various scenarios analyzed in the RIA would be substantially less than EPA currently estimates.

Department of Energy
Washington, DC

ATTACHMENT II

APR 16 1999

Comment Clerk
Docket Number W-98-30
Water Docket (MC4101)
U.S. Environmental Protection Agency
401 M Street, SW
Washington, DC 20460

Dear Sir or Madam:

Enclosed are comments prepared by the Department of Energy's Office of Environmental Policy and Assistance on the "Health Risk Reduction and Cost Analysis for Radon in Drinking Water" (EPA-815-Z-99-002). Please contact James Bachmaier of my staff at 202-586-0341 or james.bachmaier@eh.doe.gov, if there are any questions on these comments.

Sincerely,

Raymond P. Berube
Acting Director
Office of Environmental Policy and Assistance

Enclosure

DEPARTMENT OF ENERGY COMMENTS ON THE HEALTH RISK REDUCTION AND COST ANALYSIS FOR RADON IN DRINKING WATER (EPA-815-Z-99-002)

The Department of Energy's (DOE) Office of Environmental Policy and Assistance has reviewed the Health Risk Reduction and Cost Analysis for Radon in Drinking Water (HRR&CA). The document provides estimates of health benefits, primarily in terms of reduction of fatal cancers, and costs associated with reduction of radon in drinking water to certain recommended levels. The HRR&CA analysis depends, in part, on a report commissioned by THE Environmental Protection Agency (EPA) and drafted by the National Research Council (NRC) entitled "Risk Assessment of Radon in Drinking Water". The NRC report touches on a significant shortcoming of the HRR&CA when it comments that "…stopping smoking is the most effective way to reduce the risk of lung cancer and reduce the risks associated with radon". The NRC report also concludes that the total estimated population risk from radon in community water systems is 160 fatal cancers (142 from progeny inhalation and 18 from ingestion), compared with 15,400 – 21,800 fatal cancers from inhalation of radon in indoor air. An estimated population risk of 700 lung-cancer deaths each year is attributable to "exposure to natural levels of radon while people are outdoors". The risk from exposure to radon in drinking water seems trivial in comparison with that from radon in indoor air, and small when compared to that from radon in outdoor air. Although the Safe Drinking Water Act only provides EPA with limited flexibility in selecting alternatives for reducing radon exposures (i.e., by providing for the development of an Alternative Maximum Contaminant Level), it would be informative to the public and to the regulated community for EPA to evaluate the costs and benefits of a wider range of alternatives for reducing the health effects of radon exposure. Comparison of the risk reduction from reducing radon in indoor air or reducing smoking would add valuable perspective to the costs and benefits of reducing radon in drinking water.

Many of the DOE concerns expressed in the November 15, 1991 memorandum from Raymond F. Pelletier to the EPA Office of Ground Water and Drinking Water (copy attached) apply to the HRR&CA, and should be addressed in the Regulatory Impact Analysis that is being performed in support of this rulemaking. The HRR&CA does not include an analysis of either risk or cost associated with potential occupational exposures to radiation and radioactive material at water treatment facilities or with disposal of wastes in sanitary sewers or at offsite waste disposal facilities. There is also no consideration of the potential for generating radiological or mixed wastes as a result of radon removal from source waters.

GENERAL COMMENTS

There are a number of aspects of cost and risk related to regulating radon and other radionuclides in drinking water that were not addressed in this analysis, either due to lack of data or a lack of time to complete the analysis. There are other aspects that DOE feels should be considered in all drinking water rulemakings related to costs and risks that EPA has traditionally not considered. DOE has identified some of these issues in the 1991 comments referenced in the preceding section and in the detailed comments that follow. There may be others. DOE expects that EPA will include full analyses of all costs and all reductions in risk (benefits), as well as new risks created, in the Regulatory Impact Analysis that will be prepared in support of the proposed and final rules.

DOE is concerned that the HRR&CA for radon may not be a proper model for analyses of other possible rulemakings, including the anticipated revisions to the National Primary Drinking Water Regulations (NPDWR) for the other radionuclides, since radon is an atypical drinking water contaminant. It is atypical for the following reasons:

1. Radon is naturally-occurring and, therefore, not associated with a specific industrial or commercial source;
2. Radon is primarily a health risk through inhalation, not ingestion, whereas ingestion is the primary pathway for other drinking water contaminants;
3. Radon in drinking water is treated primarily through aeration, not through filtration or chemical treatment processes;
4. The primary health risks associated with radon are more appropriately addressed by regulatory and non-regulatory activities outside of the scope of the Safe Drinking Water Act (i.e., those that are aimed at reducing indoor air levels and at anti-smoking incentives). Congress recognized this matter when it linked AMCLs to multi-media mitigation programs.

Therefore, the HRR&CA for radon may set a poor precedent for similar analyses for future drinking water regulations. To ensure that this analysis does not set an inappropriate precedent for future analyses, DOE suggests that EPA consider the following issues when conducting future HRR&CA's.

1. When evaluating the costs and benefits of the rulemaking, EPA should consider the creation of new risks as a result of establishing regulatory control over a new contaminant. New risks include exposure to workers at a water treatment plant where treatment residuals are managed, as well as exposure to the general public resulting from management and eventual disposal of water treatment plant residuals. In the latter case, EPA's guidance [3] recommends disposal of water treatment plant residuals containing radionuclides below certain levels in the municipal sanitary sewer system. Disposal of any waste containing radionuclides to a municipal sanitary sewer system results in an increase in radiological contaminant levels in the sludges generated by the publicly owned treatment works (POTW). Such sludges are typically managed by POTW workers who are not protected as "radiation workers". The sludges at many POTWs are either applied to agricultural lands or are processed as commercial fertilizers and soil conditioners for unrestricted residential use. Although these "beneficial uses" of POTW sludge are regulated under programs developed pursuant to Section 503 of the Clean Water Act, there are no standards for radiological contaminants. Therefore, there is no mechanism for determining what exposures or risks may result from disposal of water treatment plant residuals. The analysis of the costs and benefits of additional or revised NPDWRs for radiological contaminants must include an analysis of the potential impact of waste management, including the effect on POTW sludges and the possible pathways of exposure to POTW workers and to the general public.

2. When remedial goals or cleanup levels for radiologically contaminated soils and ground water are set, based on RCRA or CERCLA requirements, the Maximum Contaminant Levels (MCL) are typically used as ground water protection standards or reference points. This is justified in the RCRA and CERCLA cleanup programs by making the assumptions that the contaminated ground water is a potential future source of drinking water and that future users of this drinking water source would not necessarily treat the ground water to meet the MCL before ingestion. While DOE's position has been that the MCL is not an appropriate ground water protection standard in the context of a RCRA or CERCLA remediation, nevertheless, the MCL is used for setting cleanup levels at many sites. Additionally, the MCL is used in the development of other standards, such as 40 CFR Part 191, which addresses high level radioactive waste, and draft rules for low-level radioactive waste (40 CFR Part 193) and for cleanup of radiologically contaminated sites (40 CFR Part 196). Therefore, EPA should evaluate the incremental costs associated with ground water remediation at RCRA and CERCLA sites, as well as the implications for DOE cleanup and radioactive waste management, resulting from establishing additional or revised MCLs for radiological contaminants in drinking water.

   Since radon is naturally-occurring, it is not likely to be included as a contaminant of concern at a RCRA or CERCLA site where a cleanup level would be set, except where radium is a primary contaminant. However, other radiological contaminants, either man-made or technologically enhanced, would be subject to remediation, and therefore, a cleanup level would be set. Other analyses similar to the HRR&CA for radon should, therefore, evaluate the costs associated with the use of the new or revised MCL as a ground water protection standard in the context of a RCRA or CERCLA cleanup.

3. When setting new or revised MCLs for any contaminant, EPA should evaluate the potential impact (risk reduction and cost) on owners of private wells. Although private wells are generally not subject to NPDWRs promulgated pursuant to the Safe Drinking Water Act, the levels set for drinking water quality in public water systems may be either adopted voluntarily or required under authority of a state or local health department or other agency responsible for the quality of drinking water from private wells. There are a substantial number of people across the country that derive their drinking water from private wells. EPA

[3] "Suggested Guidelines for Disposal of Drinking Water Treatment Wastes Containing Radionuclides", Office of Ground Water and Drinking Water, U.S. EPA. June 1994 Draft

should conduct an analysis of the cost and benefits resulting from the adaptation of the various levels considered in this rulemaking to private wells.

4. EPA has not included the costs or benefits of the various levels being considered for the MCL for radon that would be realized by the owners of non-community, non-transient water systems (NCNTWS), due to lack of time to gather data to complete the analysis. From data presented in the HRR&CA, the number of such systems is significant, and the average radon levels in the source water for these systems may be 60% higher than in community water systems. The MCL for radon would apply to an NCNTWS even though the patterns and levels of exposure through ingestion and inhalation would not be consistent with residential exposure. In addition, it is not clear how an AMCL would apply to a NCNTWS, assuming a state-wide multi-media mitigation (MMM) program were approved by EPA. If the state-wide MMM program were directed strictly at residential and commercial buildings, and schools, and not necessarily at an industrial facility such as a DOE weapons production facility or a national laboratory, the presumed reduction in radon levels in indoor air may not be realized. Therefore, the state may determine that the AMCL is inappropriate for these facilities, and may implement the MCL for industrial facilities that operate NCNTWS. This is an issue for the individual states and has apparently not been addressed by EPA in the HRR&CA, since the costs and benefits related to NCNTWS were not included. Future analyses must include NCNTWS and must consider the possibility that a state-wide MMM program may not apply to a DOE facility, and therefore, the AMCL does not apply.

SPECIFIC COMMENTS AND RECOMMENDATIONS

Page 9566, Executive Summary

There is no Table 7.3 (referenced in last paragraph before **2. Introduction**).

RECOMMENDATION: This table should be added to simplify the cumbersome risk/benefit comparisons made in the Executive Summary between mitigation of radon in drinking water and the MMM program implementation scenarios.

Page 9573, Section 3.5

The total estimated population risk from radon in community water systems is 160 fatal cancers (142 from progeny inhalation and 18 from ingestion), compared with 15,400-21,800 fatal cancers from inhalation of radon in indoor air. The public summary of *Risk Assessment of Radon in Drinking Water* (National Academy of Sciences), page PS-4, (from which the EPA estimates are drawn) estimates a population risk of 700 lung-cancer deaths each year attributable to "exposure to natural levels of radon while people are outdoors." The risk from exposure to radon in drinking water seems trivial in comparison with that from radon in indoor air, and is even significantly less than that from radon in outdoor air.

RECOMMENDATION: A more broadly based comparison of alternatives should be performed to determine the optimum regulatory approach. In particular, the alternatives should compare the risk reduction and costs associated with reducing radon in drinking water with those for reducing radon in indoor air.

Page 9573, Section 3.6

EPA acknowledges, "The frequency with which radon treatment would also reduce risks from other contaminants, and the extent of risk reduction that would be achieved, has not been evaluated quantitatively in the HRRCA."

RECOMMENDATION: This evaluation should be performed, since it is also not clear whether there might be a risk increment from co-contaminants. Removal of organic (both volatile and non-volatile) and some inorganic contaminants by granular activated carbon (GAC), and the reduced solubility of toxic metals such as arsenic resulting from aeration, suggest that new or increased quantities of hazardous or toxic waste streams may result from treatment primarily intended for radon reduction. The likelihood that radon and hazardous or toxic materials may co-exist in the spent GAC also suggests that mixed wastes may be generated.

Page 9574, Section 3.8

EPA cites the relative risk of radon-induced cancers as 85% among ever-smokers, and only 15% among never-smokers, according to Table 3-9. This estimate is based on the public summary of *Risk Assessment of Radon in Drinking Water* (National Academy of Sciences), page PS-3, which notes that "…stopping smoking is the most effective way to reduce the risk of lung cancer and reduce the risks associated with radon." A more detailed model of risk of radon-induced cancer as a function of some measure of the level of smoking (or years since smoking ceased) would be helpful. It would seem on the surface, however, that an effective program to reduce smoking might provide a more favorable return on investment by achieving the goal of reducing radon-induced fatal cancers as part of a larger reduction of fatal cancers in a large segment of the U.S. population.

RECOMMENDATION: A more broadly based comparison of alternatives should be performed to determine the optimum regulatory approach. In particular, the alternatives should compare the risk reduction and costs associated with reducing radon in drinking water with those for reducing smoking in the U.S. population.

Page 9576, Section 4.2.2

EPA cites "Guidelines for Preparing Economic Analyses – Review Draft" (Office of Policy, November) as basis for the $5.8M central tendency value of a statistical life (VSL). The title page of this document states, "Do not cite or quote."

RECOMMENDATION: The VSL estimate should be taken from the peer-reviewed scientific literature or from agency documents that have been accepted after public review and comment. Details of the assumptions, methodology, and analysis for quantifying the VSL should be readily available for public scrutiny.

Page 9576, Section 4.2.3 and Table 4-2

EPA derives medical care cost estimates from "Cost of Lung Cancer (Draft)" (Office of Ground Water and Drinking Water, October), which is a draft final report. The costs for lost leisure and productive time for lung cancer survivors cited in Table 4-2 seem to be reversed. The first–year costs appear to have been calculated using hours lost (776 productive hours and 1,493 leisure hours) from Table II.5-14 of the draft final report, combined with the per-hour valuation of leisure ($9.64) and productive time ($12.47) from "Potential Benefits of the Ground Water Rule – Draft Final Report" (Office of Ground Water and Drinking Water, February). This calculation yields a lost-leisure cost of 1,493 h × $9.64/h = $14,393 (the lost-productive-time cost cited in Table 4-2) and a lost-productive-time cost of 776 h × $12.47/h = $9,677 (close to the lost-leisure cost of $9,886 cited in Table 4-2). No lost time is assumed beyond the first year for lung cancer survivors, which is consistent with assumptions in the draft final report.

RECOMMENDATION: EPA should review cost estimates cited in Table 4-2 for accuracy and consistency. The cost estimates should be taken from peer-reviewed scientific literature or from agency documents that have been accepted after public review and comment. Details of the assumptions, methodology, and analysis for quantifying the cost estimates should be readily available for public scrutiny.

Page 9576, Section 4.2.3 and Table 4-3

EPA derives medical care cost estimates from “Cost of Stomach Cancer (Draft)” (Office of Ground Water and Drinking Water, October). The value of productive time ($12.47/h) and value of leisure ($9.64/h) are from “Potential Benefits of the Ground Water Rule – Draft Final Report” (Office of Ground Water and Drinking Water, February). Medical care costs for survivors of stomach cancer cited in Table 4-3 do not appear to be consistent with those from Table II.2-9, *Medical Costs Through the 10th Year Post-diagnosis*, in “Cost of Stomach Cancer”.

RECOMMENDATION: EPA should review medical care cost estimates cited in Table 4-3 for accuracy The cost estimates should be taken from peer-reviewed scientific literature or from agency documents that have been accepted after public review and comment. Details of the assumptions, methodology, and analysis for quantifying the cost estimates should be readily available for public scrutiny.

Page 9578, Section 5.1.1

EPA has considered the risk downwind of radon and progeny dispersal from a water treatment facility using aeration for radon removal, but there is no assessment of risk to workers at the facility, or of the cost associated with workplace or employee monitoring for internal exposure to radon.

RECOMMENDATION: EPA should provide estimates of risk from occupational exposure to radon and costs of associated radiation protection programs at water treatment facilities and include these estimates in the analysis of costs and benefits.

Page 9579, Section 5.1.2

EPA provides no analysis of external exposures and the associated risks to water treatment facility workers or maintenance crews who may work in the vicinity of, or intimately with, spent granular activated carbon (GAC) installed for the purpose of removing radon from water. The cost of radiation protection programs which may be required as a result of gamma emissions from radon daughters (particularly ^{214}Pb and ^{214}Bi, daughters of ^{222}Rn with significant branching ratios for emission of photons with energies between 0.2 - 2.0 MeV) absorbed in the GAC also has not been addressed.

RECOMMENDATION: EPA should provide estimates of risk from occupational exposure to radon and costs of associated radiation protection programs at water treatment facilities and include these estimates in the analysis of costs and benefits.

Page 9579, Section 5.1.2

The cost of using GAC for removal of radon from water does not consider the potential for generation of radiological or mixed waste and the associated disposal or treatment costs.

RECOMMENDATION: The potential for generating radiological or mixed-waste streams and the associated costs should be estimated by EPA and included in the analysis of costs and benefits for removal of radon from water.

Page 9588, Table 6-7

The annual incremental cost ($46M) of achieving the 2,000-pCi/L level is not within the specified range ($11M-$34M).

RECOMMENDATION: The tabular entry in Table 6-7 showing annual incremental cost of achieving the 2,000-pCi/L level should be changed to a central tendency value within the indicated range of values.

Page 9596, Section 7.4

Many of the values cited in the text of Section 7 are slightly different than those obtained by evaluating the data in Tables 6.12, 7.1, and 7.2. Most of the differences appear to be due to rounding error, but this is not explicitly acknowledged or stated.

RECOMMENDATION: EPA should review these values for consistency and should provide a more detailed explanation of their derivation.

Pages 9596-9597, Tables 7.1 and 7.2

There is no straightforward presentation of cost per cancer avoided for MMM implementation, although some selected values are provided in the text. The water mitigation and MMM components of cost per fatal cancer case avoided are presented separately in Tables 7.1 and 7.2; composite values for reducing risk to the different equivalent radon levels are not given.

RECOMMENDATION: Tables 7.1 and 7.2 should be revised, or a new table added, to present costs per fatal cancer case avoided for each target radon level. Data used in the derivation of composite costs per fatal cancer avoided should be explicitly provided.

Throughout the Document

The generally accepted symbol for liter is ‘L' (see “Units outside the SI that are accepted for use with the SI,” on the World Wide Web at URL <http://physics.nist.gov/cuu/Units/outside.html>), rather than ‘l' used throughout the HRRCA. Similarly, the symbol for hour is ‘h', rather than ‘hr'.

RECOMMENDATION: Change the abbreviation for liter to ‘L' and for hour to ‘h' throughout.